CLAIMS

1. A high-strength steel sheet having excellent deep drawability, an average r value of 1.2 or more, and a composition comprising, by % by mass:

C: 0.010 to 0.050%;

Si: 1.0% or less;

Mn: 1.0 to 3.0%;

P: 0.005 to 0.1%;

S: 0.01% or less;

Al: 0.005 to 0.5%;

N: 0.01% or less;

Nb: 0.01 to 0.3%; and

the balance substantially including Fe and inevitable impurities, the Nb and C contents in steel satisfying the relation, (Nb/93)/(C/12) = 0.2 to 0.7 (wherein Nb and C represent the contents (% by mass) of the respective elements), and the steel microstructure containing a ferrite phase and a martensite phase at area ratios of 50% or more and 1% or more, respectively.

2. The high-strength steel sheet having excellent deep drawability according to claim 1, wherein the steel sheet satisfies the following relation between normalized X-ray integrated intensity ratios of (222) plane, (200) plane, (110) plane, and (310) plane parallel to the sheet plane at a 1/4 thickness of the steel sheet:

$P(222)/\{P(200) + P(110) + P(310)\} \geq 1.5$ (wherein P(222), P(200), P(110), and P(310) are the normalized X-ray integrated intensity ratios of the (222) plane, (200) plane, (110) plane, and (310) plane, respectively, parallel to the sheet plane at a 1/4 thickness of the steel sheet).

3. The high-strength steel sheet having excellent deep drawability according to claim 1 or 2, further comprising at least one of Mo, Cr, Cu, and Ni in a total of 0.5% by mass or less in addition to the composition.

4. The high-strength steel sheet having excellent deep drawability according to claim 1, 2, or 3, further comprising 0.1% by mass or less of Ti in addition to the composition, the contents of Ti, S, and N satisfying the following relation:

$(Ti/48)/\{(S/32) + (N/14)\} \leq 2.0$ (wherein Ti, S, and N represents the contents (% by mass) of the respective elements).

5. The high-strength steel sheet having excellent deep drawability according to any one of claims 1 to 4, further comprising a plated layer on a surface thereof.

6. A process for producing a high-strength steel sheet having excellent deep drawability, the process comprising a hot rolling step of finish-rolling a steel slab by hot rolling at a finisher delivery temperature of 800°C or more and coiling the hot-rolled sheet at a coiling temperature of 400 to 720°C, a cold rolling step of cold-rolling the hot-rolled sheet to form a cold-rolled sheet, and a cold-rolled sheet annealing step of annealing the cold-rolled sheet at an annealing temperature of 800 to 950°C and then cooling the annealed sheet in a temperature range from the annealing temperature to 500°C at an average cooling rate of 5 °C/s or more, the steel slab having a composition containing, by % by mass:

C: 0.010 to 0.050%;

Si: 1.0% or less;

Mn: 1.0 to 3.0%;

P: 0.005 to 0.1%;

S: 0.01% or less;

Al: 0.005 to 0.5%;

N: 0.01% or less; and

Nb: 0.01 to 0.3%;

the Nb and C contents in steel satisfying the relation, (Nb/93)/(C/12) = 0.2 to 0.7 (wherein Nb and C represent the contents (% by mass) of the respective elements).

7. A process for producing a high-strength steel sheet having excellent deep drawability, the process comprising a hot rolling step of hot-rolling a steel slab to form a hot-rolled sheet having an average crystal grain size of 8 μm or less, a cold rolling step of cold-rolling the hot-rolled sheet to form a cold-rolled sheet, and a cold-rolled sheet annealing step of annealing the cold-rolled sheet at an annealing temperature of 800 to 950°C and then cooling the annealed sheet in a temperature range from the annealing temperature to 500°C at an average cooling rate of 5 °C/s or more, the steel slab having a composition containing, by % by mass:

C: 0.010 to 0.050%;

Si: 1.0% or less;

Mn: 1.0 to 3.0%;

P: 0.005 to 0.1%;

S: 0.01% or less;

Al: 0.005 to 0.5%;

N: 0.01% or less; and

Nb: 0.01 to 0.3%;

the Nb and C contents in steel satisfying the relation, (Nb/93)/(C/12) = 0.2 to 0.7 (wherein Nb and C represent the contents (% by mass) of the respective elements).

8. The process for producing the high-strength steel sheet having excellent deep drawability according to claim 6 or 7, wherein the steel slab further contains at least one of Mo, Cr, Cu, and Ni at a total of 0.5% by mass or less in addition to the composition.

9. The process for producing the high-strength steel sheet having excellent deep drawability according to claim 6, 7, or 8, wherein the steel slab further contains 0.1% by mass or less of Ti in addition to the composition, the contents of Ti, S, and N satisfying the following relation:

$(Ti/48)/\{(S/32) + (N/14)\} \leq 2.0$ (wherein Ti, S, and N represents the contents (% by mass) of the respective elements).

10. The process for producing the high-strength steel sheet having excellent deep drawability according to any one of claims 6 to 9, further comprising a plating step of forming a plated layer on a surface of the steel sheet after the cold-rolled sheet annealing step.